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Conference on Automation;
changing technology and related problems,

January 9 = 1957 =

Fairmont Hotel,

San Francisco .

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Presented by the Institute of Industrial Relations, School of Business Administration,
College of Engineering, and University Extension, University of California, Berkeley.

CONFERENCE ON AUTOMATION -

Changing Technology and Related Problems

PROGRAM

9:00 Registration Terrace Room

9:30 Opening General Session Terrace Room

Welcome

Arthur M. Ross, Director, Institute of Industrial Relations,
University of California, Berkeley

The Meaning and Significance of Automation

Frank K. Shallenberger, Associate Professor of Industrial
Management, Graduate School of Business, Stanford University

Coffee Break

10:45 Workshop Session (See schedule for workshop group to which assigned)

12:15 Luncheon Session Gold Room

Labor Looks at Automation

Stanley H. Ruttenberg, Director, Department of Research,
AFL-CIO, Washington, D. C.

2:00 Panel Discussion Terrace Room

The Future of Hours of Work

Arthur M. Ross, Chairman

Richard Liebes, Research Director, Bay District Joint Council
of Building Service Employees

Warren R. Philbrook, Industrial Relations Director, Food
Machinery and Chemical Corporation, San Jose

Coffee Break

3:30 Workshop Session (See schedule for workshop group to which assigned)

6:00 Dinner Session Terrace Room

Industry and the Automated Future

John Diebold, President, John Diebold and Associates, Inc.,
New York, and author: "Automation, The Advent of the Automatic
Factory."

Excerpts from an address by

Assistant Secretary of Labor, Rocco C. Siciliano*
[Automation and Its Effects on the Labor Force]

One of the forms of technological advancement that has attracted wide-spread public attention is that popularly known as automation. The term holds widely different meanings, however, for different persons.

Experts testifying before the Joint Committee on the Economic Report could not agree among themselves on a single definition. The technicians tended to emphasize the introduction of self-regulating devices into industrial production through the feedback principle whereby electronic sensing devices automatically pass information back to earlier parts of the processing machine, correcting for tool wear or other items calling for control. John Diebold, who is credited with coining the word "automation," puts it this way, "When machines do a man's work, that's mechanization. When they do his work and control their own operations as well, that's automation." But the technological developments that are effecting our economy at an accelerated rate include more than this. We must consider the tremendous growth of synthetic products, antibiotics, frozen foods, the development of new sources of energy, both atomic and solar, as well as many other new goods and services. A comprehensive survey of more than 15,000 companies just completed by the Department's Bureau of Labor Statistics reveals that private industry invested \$3.7 billion for research and development work during 1953. This, together with \$1.3 billion spent by the Federal Government (mostly on military research and development for national defense), brought the national total to more than \$5 billion.

What does the expenditure of these enormous sums mean to us in terms of standard of living? Projecting these trends into the future, many observers foresee an era of much greater material abundance and more widespread leisure. The Joint Committee on the Economic Report, for example, recently estimated that the economy's output would reach \$500 billion by 1965, as contrasted with slightly less than \$400 billion in 1955.

Some of the products and services made possible by the new technology are already here. Atomic energy has been used to propel the new submarine "Nautilus," and will soon be used in surface ships. Experimental plants in which atomic energy will be used to produce electric power are now under construction. Scores of uses for the atomic isotope are being found in the fields of medicine, horticulture, food processing, and industrial production in a number of industries. The mass production of color television is being made possible by the development of automatic processes for placing literally hundreds of thousands of separate and individual colored dots upon the face of a picture tube, a task all but beyond human capabilities for precision and tolerance for tedium.

The availability of electronic computing machines is making possible the rapid processing of all kinds of business records and computations. Insurance companies and banks whose bookkeeping workloads were becoming

*Before the General Meeting of the Twelfth Annual Eastern Seaboard Apprenticeship Conference, Swampscott, Mass., April 23, 1956

unmanageable have found a happy solution in electronic equipment. For example, one bank whose annual computation of interest formerly required the services of scores of clerks over a three-month period now completes the job in a few days through electronic calculators. Other anticipated applications of these machines include the control of airline and railroad travel reservations and better weather forecasting. Government, too, is finding practical uses for the electronic "brain" in the compilation of huge volumes of census data and in maintaining the social security records of more than 100 million persons.

It is reasonable to expect that these technological developments will give rise to a number of new industries, although at this time it is difficult to foresee precisely what they may be. We do know that more than 1000 companies are already engaged, wholly or in part, in the manufacture of automatic control equipment. This is one of the fastest growing industries in the country, having sold during the last year more than \$3 billion worth of equipment.

Perhaps even more encouraging than the development of new industries is the potential increase in the demand for services of all kinds created by the new and improved products. The growth of the automobile industry created a demand for hundreds of thousands of garage mechanics, service station operators, and salesmen. Radio, and later television, created jobs for thousands of repairmen in cities and towns scattered throughout the Nation. It is reasonable to expect a continuation of these trends.

In general, technological change has always been welcomed in this country because we have learned that higher productivity results in more and better products, higher earnings, and a higher living standard for all. At the Joint Committee hearings not a single witness -- neither representatives of organized labor or those who spoke for industry -- voiced any opposition to automation or advancing technology.

Thus far we have dealt with the more optimistic aspects of automation. Technological change may also create serious economic and social problems. Experience has taught us that the introduction of labor-saving machinery inevitably causes personal hardships for some of the individuals whose jobs are replaced by machines. It seems apparent that changes -- comprising new methods, tools, materials, and products -- will affect the number and type of jobs in a wide range of industries. While job readjustments may mean new opportunities for some workers, for others they may result in loss of jobs and obsolescence of skills. In a free economy, some losses as a result of this shifting are the price of progress: but we should do all we can to minimize the effect upon the people affected.

In earlier years there were few measures to cushion the impact of these changes for the individual workers. Today there is a greater recognition on the part of all groups -- management, labor, and Government -- of the need for planning the human aspects of technological change as well as the financial and technical sides. Good industrial relations will anticipate the adverse effect on the people involved and by careful planning and scheduling, minimize the readjustments and losses of jobs. We must do all in our power to keep these adverse affects at a minimum.

There is another aspect of our manpower problem that I should like to discuss briefly with you. It is the problem of providing enough scientists, technicians, and skilled labor to man the industry of 5 years

and 10 years from now. It may well be that the problem of upgrading the skills of the labor force is going to present much more of a challenge in consequence of the new technology than the problem of displacement and unemployment. The new technology -- including new tools for defense-- is almost certainly going to require a higher order of skills and a different occupational distribution than that of our current labor force. This problem has not merely a domestic but an international aspect. So grave is this situation that President Eisenhower has just established a National Committee for the Development of Scientists and Engineers, comprised of representative citizens, to further the development of more highly trained technical manpower. In so doing, the President said:

"World technological leadership carries the inherent responsibility before the world of using technology to help all peoples achieve a better life through the development of their resources for the good of all mankind. How we do this will require the most intensive effort in all fields of learning. We must nourish those basic roots of our traditions and culture which lie deep in the humanities and the social sciences, and in our fundamental religious conception of the relation of man to his Maker. The attention we here focus on science and engineering will not distract us from continuing our efforts on behalf of all the other important fields of education."

In the future we need men and women with creative and imaginative minds who are flexible and uncommitted in the ways they think about their jobs. This highly educated type of manpower cannot be created overnight -- years of schooling and specialized training are necessary to prepare a "systems" engineer who can switch his activities from one production process to another with only a temporary loss of effectiveness. Indeed, there are those who believe that the shortage of engineering competence may become an important controller of the progress of automation itself, slowing up the speed of new installations.

The January 30 issue of the Wall Street Journal reported on a meeting of the Engineers Joint Council, at which deep concern over the shortage of engineers was indicated. According to the article, an estimated 5,000 companies will be bidding for the 23,000 engineers due to graduate from the Nation's colleges and universities this year. That's an average of 4.6 engineers per employer. One company alone (General Electric) would like to hire 1,000 of them. One suggestion to alleviate the shortage was a greater use of technicians--graduates of two-year technical institutions or specially trained high school graduates.

With its emphasis on electronics, on programming, on instrumentation, and on other precision operations, automation seems bound to create many new technician positions. These specialists, a grade below the engineers and scientists, back up the professional by performing many of his more routine functions and thus permit him to concentrate on the more demanding and creative aspects of his work. They also include the "programmer" who prepares information and feeds it into the machines. Since the technician requires less education and training than the professional, the supply can be increased more rapidly. With proper planning and organization of

the use of technicians, the limited supply of engineering and scientific talents can be greatly extended.

What of the skilled worker in existing trades and crafts? Will the need for his services decrease? There is some evidence that firms converting to automation find they need more skilled workers in existing trades than before. For example, a large motor company which now produces complete engine blocks on an entirely automatic assembly line has been unable to recruit the number of skilled manual workers needed to build and maintain the equipment and has had to expand its apprenticeship training program. It seems probable, therefore, that the demand for electricians, millwrights, tool and die makers, all-round machinists, and many other skilled craftsmen will increase, not only as a proportion of the manufacturing work force, but as an absolute increase as well. This means an ever-greater opportunity for apprenticeship programs, and also emphasizes the need for stepped-up journeyman training, and for refresher courses.

Mass production methods and material handling equipment developed during the first half of the 20th century reduced the need for unskilled manual labor and created a demand for semi-skilled machine operators. In a similar manner anticipated technological changes are expected to reduce the need for semi-skilled machine watchers, assemblers, and some types of routine clerical workers. The jobs of this group consist mainly of simple repetitive operations of feeding or manipulating a machine which electronic or mechanical devices now perform more quickly, more continuously, and more accurately. If the shift from such jobs can be accomplished without undue hardships it will be an important step in freeing people from necessary, but deadening machine-paced tasks. As Dr. Vannever Bush recently suggested, we should hold as a great social gain industrial changes that abolish inherently dangerous, burdensome, or monotonous jobs and replace them with jobs having variety and judgment.

We must also consider the possible indirect effect of automation on the skills of the work force. Any substantial increase in industrial productivity is bound to accelerate the rate at which our per capita income grows. Experience has demonstrated that as family income increases we tend to spend more on things that can only be provided by people with relatively high skills. For example, we are today spending a much higher proportion of our income on medical services, education, books, and music. As we fill our homes with all kinds of mechanical equipment, dishwashers, dryers, televisions, air conditioning, and so forth, we create an increasing demand for skilled repairmen. There has already been a sharp rise in employment in these occupations and there is every reason to believe it will continue. There are those who believe that the indirect effects of increasing industrial productivity will create a demand for more skilled people than will be required by the automated industries themselves.

What are the implications of these prospective developments for education and training? The primary responsibility for training and retraining the current labor force must lie with individual firms. Only they will be able to determine their specific training needs. The type of worker needed to design, build, operate, and maintain the new equipment cannot be recruited on the open market. The cost of good training programs of all kinds is a legitimate charge against the savings effected through

automation. The important thing is to anticipate future manpower requirements and to set-up training programs well in advance of the time of installation of the new machines. Companies which pioneer in the development of the new technology will be wise to share with other firms their "know-how" and experience accumulated in converting their work force to automation. There is no better insurance against labor pirating.

Schools and colleges must give careful thought to the planning of their curricula and the quality of their instruction in the light of these developments. New courses that dovetail with changed apprenticeship curricula, and with journeymen training need to be devised. Courses in science and mathematics must be strengthened and more qualified students encouraged to enroll in them. Vocational guidance services must also be greatly improved and expanded in order to enable our youth to choose vocational fields in which their individual abilities and talents can be most fully utilized.

For the individual, automation presents a challenge which can only be met with initiative and a sincere desire to make the most of his innate abilities. He must actively seek to obtain all the education and training he can. According to Dr. Adam Abruzzi of Stevens Institute of Technology, automation will revolutionize the current standards for judging worker performance. In a fully automated factory, worker evaluation will be based on a worker's ability to control automation processes and prevent them from breaking down, rather than on the quantity of work turned out. A worker's value will depend upon his ability to diagnose the source of trouble in a breakdown and take swift, remedial action.

The U. S. Department of Labor has an immediate interest and deep concern in the implications of automation for the economy of the Nation and the welfare of its people who work.

The Department's Bureau of Labor Statistics, for example, has started a series of case studies of plants which have introduced a form of automation with the objective of learning as much as possible about the conditions surrounding the planning, installing, and operating of the new equipment. Two case studies have already been completed - one involving the use of printed circuitry with automatic inserting machines in a television plant; the other involving the introduction of an electronic digital computer in the home office of an insurance company. Although illustrative, rather than representative of the industries concerned, these case studies give some indication of the economic and social consequence of automation.

In both cases the transition to automated operation was effected in an orderly manner. This was the result of good planning and good timing. In both instances a large number of semi-skilled and clerical jobs were eliminated, but no actual lay-offs occurred. Displaced workers were either retrained for higher paying jobs or were transferred to other departments in which their current skills could be utilized. In the TV company additional skilled jig and fixture men were hired for developmental work and the apprenticeship program for these and related trades were expanded. The number of mechanical and electrical engineers was increased and the company is still seeking mechanical designers, engineers, and technical writers.

At the insurance company all but one of the employees selected to operate the new equipment were current employees, the lone exception being an electronics engineer formerly employed by the computer manufacturers. The selection criteria established for the new jobs were proficiency in mathematics and college training in most instances.

Although in both of these case studies the shift to automated equipment was undertaken under favorable economic conditions, when the companies were expanding their operations, they constitute excellent examples of how careful planning and a concern for the welfare of employees can avoid most of the unfortunate consequences that some observers fear.

Concerned with the prospective shortage of scientific, professional, and skilled manpower, Secretary of Labor James P. Mitchell has set up a departmental task force to study the problem of developing skills in the work force and to help coordinate and expand the activities of the Bureaus in this field.

The activities of this group include developing improved techniques for more accurately measuring future manpower requirements, encouraging better educational planning and vocational guidance, promoting more effective and more intensive training in industry and fuller utilization of all people including women, older workers, the physically handicapped, and members of minority groups.

The Bureau of Apprenticeship, working with employers, unions, and state agencies, is promoting the expansion of apprenticeship programs as a means of augmenting the skilled labor supply, and is developing new training materials and, in general, strengthening its program both for apprenticeship and journeyman training. A task force, including a representative of the Bureau of Apprenticeship has been working on the implications of the peaceful uses of atomic energy, including training programs. The Bureau of Employment Security is expanding and improving the activities of its 1700 affiliated State Employment Service Offices which provide employment related services such as testing, counseling, community employment planning, occupational analyses, industrial services, and local labor market information. Implementing these activities the Bureau of Labor Statistics is completely revising its Occupational Outlook Handbook, one of the major sources of information for guiding young people and others in choosing their life work. Research incident to this work will provide the basic data for long-range forecasts of occupational trends upon which plans for the training of skilled workers can be based.

Other studies concerned with the special problems of the older worker and with out-of-school youth are planned. These two groups are in particular danger of being adversely affected by technological change. The former because his skill may be made obsolete and the latter because his lack of education and training make him unqualified by the higher standards of worker performance demanded by automated processes.

I have endeavored, in the brief time we have been together today, to present some of the optimistic as well as some of the pessimistic aspects of automation and technological change. On balance I am personally inclined to take the optimistic point of view. That there will be problems for some individuals and perhaps for certain communities I am well aware. And where these occur every effort on the part of management and labor, government,

and the community must be marshalled to soften the blow. I cannot help but feel that a civilization, which has developed the genius to control the atom and to create machines that think, will not fail to solve the human problems resulting from technological change.

The challenge of automation to employers, labor, cooperating State apprenticeship agencies, and to ourselves is a tremendous one. We must help to plan training programs on a realistic, long-term basis, with an eye to the anticipated increases in our skilled work force imposed by a new industrial age.

POPULATION 14 YEARS OF AGE AND OVER

1950 AND PROJECTED 1975

PERCENT
CHANGE

MILLIONS OF PERSONS

POPULATION

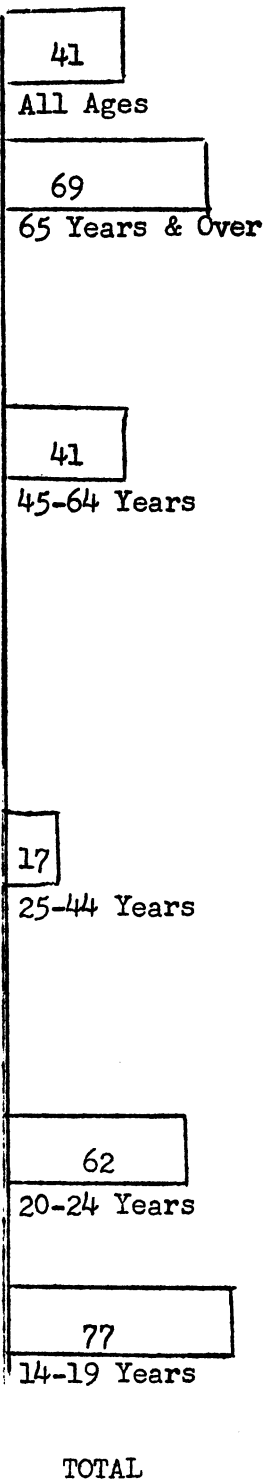
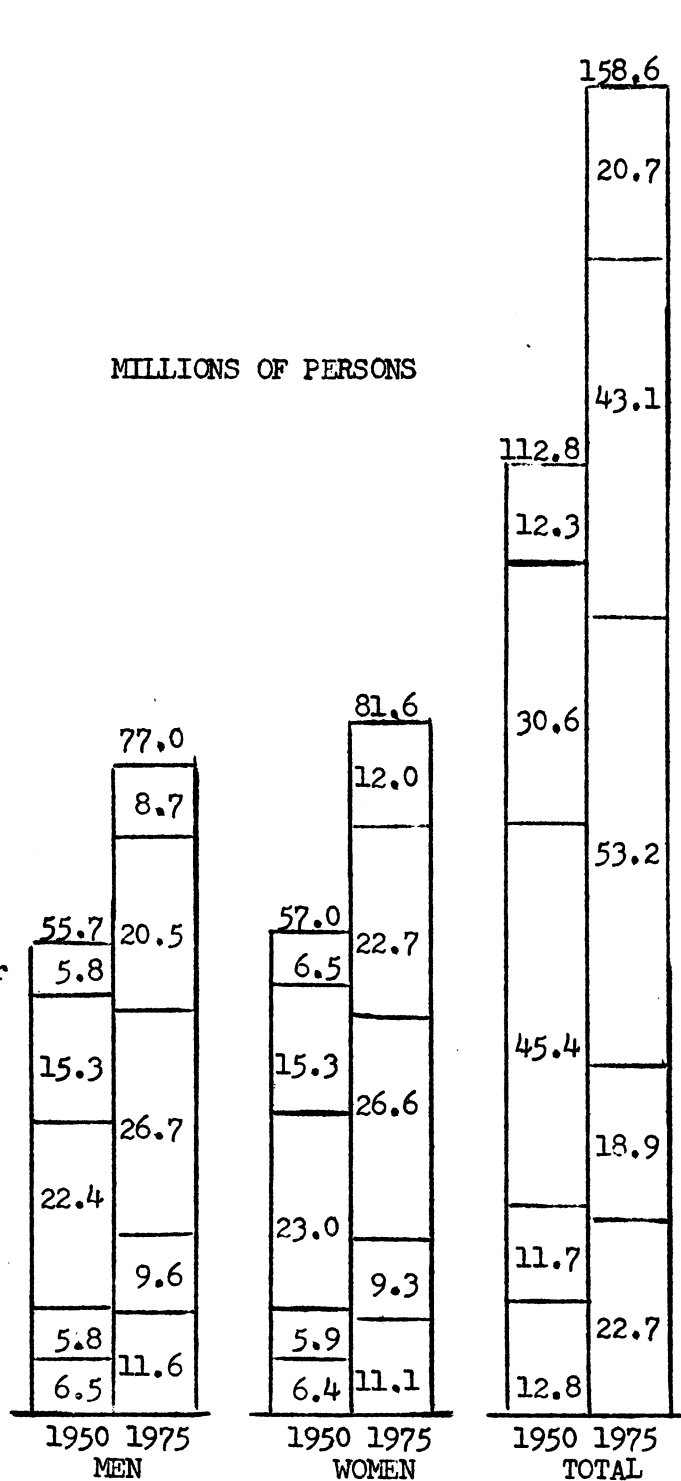
65 Years & Over

45-64 Years

25-44 Years

20-24 Years

14-19 Years



United States Department of Labor
Bureau of Labor Statistics

Source: U.S. Bureau of the Census

OCCUPATIONAL SHIFTS, 1910 - 1950

Percent of Total Workers Engaged in Each Field

	1910	1950
FARM AND UNSKILLED LABOR OCCUPATIONS DECLINED.....		
Farmers (Owners and Tenants)	16.5	7.5
Farm Laborers	14.5	4.6
Laborers, except farm	14.7	7.8
SKILLED WORKERS HELD THEIR OWN.....		
Skilled Workers and Foremen	11.7	13.8
ALL OTHER FIELDS INCREASED.....		
Semi-skilled Workers	14.7	22.4
Clerks and Kindred Workers (including salespeople)	10.2	20.2
Proprietors, Managers and Officials	6.5	8.8
Service Workers	6.8	7.4
Professional Persons	4.4	7.5

United States Department of Labor
Bureau of Labor Statistics

Source: U.S. Bureau of the Census
1950 estimated by Bureau
of Labor Statistics

CHANGING TECHNOLOGY AND WORKER ADJUSTMENT

Workshop Questions:

1. What is automation? Evolution or revolution?
2. What is automation for, what are its objectives?
3. What are computers and what is their role in automation?
4. To what extent can automation be utilized in the factory? In the office?
5. What are some of the obstacles to introduction of automatic equipment in the office and the factory?
6. What factors should management consider before going into automation?
7. What product and process design problems are presented by automation?
8. Will widespread technological unemployment accompany increasing application of automation?
 - a. Will the rate of introduction allow easy adjustment?
 - b. Will more jobs be created than destroyed?
 - c. Which jobs will be most affected? (Unskilled, semi-skilled, skilled)
 - d. Which workers will be most affected? (Older workers, women, men)
9. How will the conditions of work be changed for the individual employee under automation?
10. What are the implications of automation for industrial relations?
11. If automation results in generally increased productivity in industry, how should the gains of productivity be shared?
 - a. Higher wages?
 - b. Shorter hours?
 - c. Increased benefits?
 - d. Regularized employment?
 - e. Lower prices?
- 12.. If automation greatly increases industrial productivity and allows the work week to be shortened drastically, will "excessive leisure" create social problems?

LABOR NEEDS, TRAINING, AND LABOR UTILIZATION

Workshop Questions:

1. Will labor shortage or surplus result from future introduction of automatic processes?
2. Who is responsible for training and retraining? How should cost of training be allocated?
3. What specific skills will be most needed in the future?
4. In what industries will the greatest changes in training needs and employment occur?
5. Will jurisdictional problems arise from new skill requirements?
6. How should problems resulting from transfers, layoffs and promotions due to new skill combinations be met?
7. What steps should be taken to insure the best utilization of the labor force?
8. Will there be problems concerning the effective utilization of women in the work force of the future?
9. How can the older worker and the handicapped person be best utilized?
10. Where does the responsibility for re-training and readjustment of technologically displaced persons lie?
11. How can we insure the best utilization of displaced persons over 35 years of age?
12. How should information regarding training requirements, labor shortages and mobility needs be dissiminated?
13. What percentage of the work force will be made unemployable by the elimination of semi-skilled and un-skilled jobs? Are there those who are not mentally or psychologically retrainable?
14. To what extent should immigrant labor be used? What is the most efficient method of utilizing immigrant labor?

Shortening Work Week*

Clark Kerr
Chancellor, University of California, Berkeley

Hours of work are certain to be a most important issue over the next decade or so. The "standard" work week in the United States has remained quite constant, at 40 hours, for about twenty years, although it is true that more persons are now below 40 and fewer above than twenty years ago and thus the average week actually worked has declined. But 40 hours was considered a "normal" work week in the middle thirties and it is still so considered today. In the meantime, productivity has increased and is continuing to increase quite substantially.

We are now approaching a period of re-evaluation of this normal in our effort to work out a reasonably acceptable balance, on an economy-wide scale, between income and leisure. How much are hours of work likely to be reduced? How will this new leisure be distributed over the working year and the working life? What may be some of the consequences of this new gain in leisure? How will our social processes effectuate this reduction of working time and the distribution of the new leisure?

The preceding speaker has given us several models for the year 1970, assuming the 37-hour week and the 30-hour week. I assume that his statistical calculations are accurate and shall comment on other aspects of his paper and on the problem of reducing hours generally.

First, the speaker assumes an annual increase in man-hour productivity of 3 per cent a year. No one, of course, can do more than guess about what it will be a decade or a decade and a half ahead. My guess is that 3 per cent may be a bit high. Manufacturing industry may well make the 3 per cent suggested, particularly with new automatic ~~devices~~ and perhaps also new sources of power. But 2.5 per cent appears high for other nonagricultural pursuits, which increasingly means restaurants, beauty parlors, and the like where productivity is as difficult to raise as it is to measure. And agriculture can hardly keep pushing ahead at a rate of 5 per cent a year. Many if not most farmers now have tractors and access to purebred bulls and know about commercial fertilizers. And if a growing government sector is added in to the calculations -- and man-hour productivity is assumed to be fairly constant in the public sector -- then the 3 per cent rate seems even more optimistic. The Dewhurst assumption of 2.3 per cent (without government) appears more realistic. The assumption about the annual productivity increase is absolutely basic to all forecasting about hours of work.

The speaker also appears overly optimistic in one of his models which assumes a 10 per cent increase in labor's share of national income. On past performance of this and other economies on which statistics are available, such an increase in labor's share over a decade and a half, barring a catastrophic depression, which he does not assume, would be one of the great social phenomena of the century.

*Discussion before Sixty-Eighth Annual Meeting, American Economic Association, New York, December 29, 1955.

The second basic assumption in predicting hours of work has to do with how increased productivity is shared out between increased income and increased leisure. It is fairly common to assume that the division is about half and half. This was the apparent rate of sharing in the United States over the past century. This seems to me to be too high a share for leisure looking ahead for the next ten or fifteen years in the United States. First, the ratio has been shifting in favor of income in more recent times: it was 60 per cent for income and 40 per cent for leisure for the period 1920 to 1950. It seems likely this shift will continue, for the desire for added income is probably more insatiable than for added leisure. At some point (and one with many fewer working hours per year than now), the share for income will approach 100 per cent.

Second, the recent share for leisure in the United States appears comparatively rather high. Perhaps it occurred because we moved quite quickly and comparatively early to the 40-hour week. It has been not 40 per cent but about 20 per cent for a similar period of time (approximately 1920 to 1950) in Great Britain, Sweden, and Australia. France is a great exception and the ratio there is the other way around. Whether this is the result of the historical fact of the great hours reduction during the Blum regime coupled with a relatively unprogressive economy, or just the Gallic sense of values at work, or something else, I do not know.

Third, these ratios are quite erratic. In Sweden, for example, the share of leisure was 60 per cent from 1918 to 1924 and 5 per cent from 1924 to 1947. Generally, hours go down most in depression periods or postwar periods (which have often been the same thing) -- like they did in the Great Depression and post-World War I in the United States. No similarly spectacular changes usually occur in periods of steady prosperity. Hours of work are a kind of convention of the market place and changes in the normal practice, as with many customs, tend to come in spurts. Wages, on the contrary, are normally subject to fairly constant change and thus the income share is open to fairly constant increments, with increments in the leisure share coming more erratically as hours of work are reduced in periods of major economic adjustments to catch up with or perhaps run ahead of the long-term trend. Whether such a period of major economic adjustment will occur over the next decade and a half, no one can predict with certainty. In the absence of such a period, I would expect a relatively modest reduction of hours of work -- rather less than the historical 50-50 ratio would suggest and less than the 3 hours a week per decade which was the average for the past century, and certainly less than the 4 hours per decade which was the average for the first half of this century. Dewhurst suggests a little less than 2.5 for the decade 1950 to 1960. It might be noted, parenthetically, that the 3 hours reduction per decade over the past century was partly due to a shift in the industry "mix" from agriculture with long hours to non-agricultural activities with shorter hours.

If productivity rises less and the leisure share is smaller than sometimes assumed, then hours of work will not go down so spectacularly as some predict; but they will decrease significantly. What form may this reduction take? Since 1940, a substantial proportion of the actual reduction in hours per week (averaged over the year) has come in the form of a general introduction of vacations and a lengthening of these vacations and of more holidays. It seems likely this trend may continue to a degree, although there are many suggestions for the six-hour day or the four-day week. As between these two, considering particularly the increasingly heavy invest-

ment in daily commuting time for many employees, the four-day week may turn out to have the greater appeal. Assuming a reduction of 2.5 hours in weekly working time averaged over the year each decade for the fifties and sixties by 1970 the standard scheduled work week might be reduced from 40 to 35 or the standard vacation period might be raised from two to eight weeks per year or some combination might be worked out like a four-day week every second week (which would amount to a holiday with pay every second week) and a four weeks' vacation with pay. By 1970 I should expect that hours per week, averaged over the year, might be about 33 as a norm in manufacturing industry instead of the norm of 38 which applied in 1950.

The possible approaches are almost infinite in number and there is almost certain to be great debate about them particularly within unions and between unions and management. The reduction in the scheduled work day and work week was a quite obvious solution when employees were working past the point where excessive daily and weekly fatigue set in, but this is no longer the situation and other alternative ways of reducing working time may appear increasingly attractive.

Just as there may be a great deal of internal debate about the matter, so also there may be a great deal of variation in solutions. Already there are some scheduled 30-hour weeks (mostly developed during the depression years, however) and some vacations with pay of four weeks. University faculty members, managers and their assistants and others may generally favor the longer work week coupled with longer vacations, while manufacturing workers may choose a shorter work week and shorter vacations, and so forth. Residents of small towns may have one preference and of large metropolitan centers another. The concept of the "standard" work week may largely disappear in a welter of arrangements as men have more real choice in the distribution of their leisure hours. The new standard, to the extent there will be any standard at all, may be in terms of hours scheduled per year, which now run a little less than 2,000 and by 1970 may be a little over 1,700. By that time, we may be talking about a "1,700 a year" contract, instead of a "40 a week" one. Putting it this way gives men a better chance to get an optimum distribution of their leisure time around the year and limits them less in their range of choices than does the emphasis on the scheduled work week alone.

The reduction in working time and the form in which it is taken will have many consequences of which I should like to indicate four. First, there will be effects on productivity per man-hour. Historically, the reduction in weekly hours of work has helped make possible the increased average tempo of effort and thus shorter hours have in part paid for themselves. Whether this will continue in the future, or at least to the same extent, is certainly problematical. Particularly if the reduction of working time takes the form of the six-hour day or the four-day week, a higher proportion of hours will be spent in the relatively inefficient "breaking in" and "breaking out" times. The first hour in the morning and the last hour in the afternoon and Monday mornings and Friday afternoons are generally low output periods. Just as there is an "optimum output" work week in the sense of maximizing total output per worker over some period of time (a consideration of importance now only in a period of a major war), there must also be an optimum output work week from the point of view of maximizing hourly output per worker -- up to which point a reduction of weekly hours increases average output per hour and beyond which it reduces it. (Quite conceivably there is no such "neutral" point but rather a substantial range within which a change in hours worked, in and

of itself, has no impact one way or the other on hourly output per worker.) The form to be chosen for the reduction in working time might well be affected by these efficiency impacts.

But there are other results for productivity. Shorter working time may mean less absenteeism on the part of the bulk of workers: it is both less attractive and can less well be afforded since each hour is a constantly higher percentage of scheduled working time. Also, injuries will be fewer and in other ways the average length of working life will be prolonged. More years are spent now outside the labor force -- with longer periods of education at the start of life and of retirement at the end -- but average years inside the labor force have also lengthened. Some amount of annual working time is also "optimum" from the point of view of maximizing the working span of life; and it will vary, of course, very greatly from occupation to occupation. Additionally, more nonworking time may well lead to training and other activities which raise the average level of skill. Because of these and other factors, the productivity consequences of a reduction in working time are quite complex -- and also not negligible.

Second, there will be effects on the size of the labor force -- and probably generally to increase it. Particularly if scheduled hours per day and per week are reduced, more women, more aged, more students will be drawn into the labor force. Also, more people will have second jobs (like some rubber workers in Akron), so that the number employed conceivably might come to be more than the number of people in the labor force, despite frictional unemployment.

Third, the volume of employment may become more constant. Traditionally, the work week has been fairly fixed and the work force variable. This is being reversed with the work force becoming fixed and the work week variable. Many reasons lie behind this trend, but one among them is that the work week is more readily expansible with less grumbling and other undesirable effects (like excessive absenteeism) when it is relatively short instead of relatively long. The level of employment will come to be more meaningfully measured by the number of hours worked instead of the number of persons employed; and national policy will come to be more directed at a certain level of hours of work than of employment. Incidentally, I think Stewart in his models sets a rather low figure for unemployment at 3 per cent; 5 per cent appears more nearly "normal" for the American economy.

Fourth, consumption patterns will undoubtedly be much affected by the reduction in working time. Everything else remaining equal (which it will not), more leisure might well mean a higher propensity to consume. The direction of consumption expenditures will be much affected by the increased amount of leisure but particularly by the form it takes. Certainly a higher percentage of income will be spent on travel, gardening, and many other activities, and the demand for many governmental services, like highways, libraries, and parks, will rise.

The process of developing and then enforcing the new rules of society regarding working time is likely to be somewhat painful. The law may be less helpful in setting new norms than it was in the thirties. Below the eight-hour day and the five-day week, the humanitarian drive, to protect health and to create conditions conducive to good citizenship, lying behind governmental action is much reduced. In the absence of a major depression,

there is also less of a clear call for a public policy to share the work. Additionally, the variety of patterns of working time, which are almost certain to develop, will create for government less of a clear-cut minimum practice to be extended by law. More of the decisions will be left to collective bargaining, and here the concern of employers in increasing efficiency and of the unions in creating a satisfactory income-leisure balance for their members may pull to a lesser extent in the same direction, although it should be noted that they never did pull at anything like the same rate. Further, the unions will be subject to many more points of view internally about the proper balance between greater income and greater leisure and the proper method of distributing the greater leisure over the year than in the past. Finally, in the new era of constant full employment and international peace (which we hopefully think we are in) there are fewer natural crises in which the customs about normal working time can easily be changed. A consciously man-made crisis in the collective bargaining arena may have to be fashioned as a substitute.

Enforcement of the new rules will also be difficult. Ideally, each man, like Robinson Crusoe or the boy in the blackberry patch, would work as long as the added utility of the income more than offset the added disutility of the work and then he would quit. But this would vary greatly from man to man and even day to day for the same man. The scheduled hours of work at best can be only an approximation of what the labor force desires, and a rather crude approximation at that. Adherence to the scheduled hours will be increasingly hard to obtain for at least three reasons. First, more people all the time are being covered by such schedules and fewer are left to their own self-choice; and thus the magnitude of the enforcement problem expands. Second, full employment gives more people a chance to get around the schedules by working at second jobs if the standard schedules are too short for them or getting away with absenteeism if they are too long. Third, as the labor force becomes more diversified (through drawing in women, students, the aged), it becomes more impossible to get a schedule which satisfies both the fully committed and the partially committed members of the labor force; and hours scheduled and hours worked will bear less and less relations to each other. (Hour schedules are coming to determine more the wage rate paid than the number of hours actually worked.) All this will create problems for management and to a lesser extent for unions; but not necessarily for the workers. Along with the growing social right to a job may develop more of an accepted right to fit the hours on a job, within reason, to one's own desires.